

**INVESTIGATING A POSSIBLE SHORTAGE
IN
HUMAN RESOURCE ASSESSMENTS**

**EXECUTIVE ANALYSIS OF FIRE SERVICE OPERATIONS
IN
EMERGENCY MANAGEMENT**

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ABSTRACT

This research paper reviewed the general characteristics of natural disasters and the roles of fire departments and supporting agencies in emergency responses following their occurrence. Recognizing that many volunteer firefighters may be employed by agencies that would be needed to stabilize hazardous situations during disaster operations this paper attempts to identify the resulting loss of personnel due to the critical nature of their full time occupations.

This paper employed historical research to identify (a) the types of natural disasters that threaten Morris County, (b) the common tasks required to mitigate these events, (c) the recommended staffing for fire departments, and (d) by survey, the reported staffing and possible detractors of local fire departments. Action research was then used to create a chart for identifying possible personnel restrictions.

The primary procedure was to gather and review current literature regarding the subject. The second was to interview local Emergency Management coordinators. The third was to conduct an informational survey of local departments.

The material was reviewed and employed to create the chart for identifying personnel restrictions. This paper recommends a heightening of awareness using the chart in preparing for natural disasters.

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INTRODUCTION

The Morris Township Fire Department is a combination department in northern New Jersey in which approximately 80% of the suppression personnel are volunteers. Because of their full time occupations and membership in other emergency service organizations there may be a conflict of availability during a natural disaster that would seriously reduce the number of firefighters that are able to respond to fire and emergency situations.

It is the purpose of this paper to evaluate the staffing levels that would be available to local fire departments if a natural disaster was to occur in this county and present that information in a reproducible chart. That chart could then be used by other fire departments to assess their own staffing levels in the prescribed situations. Historical research was used to examine the nature of the essential tasks and personnel required to successfully mitigate emergency situations during natural disasters. It then compared the number of personnel available to those needed in several possible scenarios.

Historical research was used to answer the following questions:

1. What types of natural disasters are probable threats to Morris County?
2. What are some of the common tasks required to mitigate these disasters that would necessitate inter agency support operations?

3. What is the recommended versus reported staffing available for the local fire departments?

Action research was used to create the chart that will display some of the variable tasks that can reduce a department's human resources. The recommended staffing levels required for structural firefighting are then compared to the personnel available in probable scenarios from the historical research.

The results should indicate if the capability assessments of the local fire departments may be overestimating their available staffing during natural disasters because of the commitment of personnel to other essential services.

BACKGROUND AND SIGNIFICANCE

The Morris Township Fire Department is located in the County of Morris in northern New Jersey. It is comprised of a combination of career and volunteer members. Typical staffing on weekdays between the hours of 0800 and 1700 is one Chief, one Deputy Chief, one Career Captain, two Firefighter/Inspectors, one Firefighter/Mechanic, seven career Firefighters, and any available volunteer members. Volunteer members may range from 6 to 20 on any given day. After 1700 the

department is staffed by two career firefighters. All other members are on call as needed. The volunteer ranks rise during the evening hours to approximately 50 active members. However, Morris Township is not immune from the current trend of shrinking ranks among the volunteer members (Hester, 1998).

The volunteer members of the department come from numerous backgrounds and occupations. The Morris Township Department of Public Works employs approximately 10 of the active members. Several members are in law enforcement and two are career members of other emergency response agencies.

During the mid 1980's fire departments in the area began to allow members to volunteer their services to more than one fire department to help alleviate personnel shortages during weekdays. That was meant to allow a person to serve as a volunteer in both the towns where they resided and where they were employed. This trend also extended to members joining first aid squads as well as fire departments.

In Morris Township several volunteer firefighters were also members of the Office of Emergency Management. Eight members have joined local first aid squads. Four are active with other volunteer fire departments. And three are part-time employees of a hazardous materials clean-up firm.

When taken into consideration the members of the Morris Township Fire Department are extremely dedicated to the protection of the lives and property of the citizens they serve. However, if a disaster strikes they can only fill one role at a time.

Although Morris County has several mutual aid pacts servicing the majority of its departments, many towns may be facing the same personnel situations. In the event of a natural disaster, multiple jurisdictions will be forced to respond to incidents in their own towns and not be able to fulfill their mutual aid assignments. Because of the need for utility support, many of the active volunteers may be required to remain at their places of employment. Thus, the firefighting forces may be significantly reduced. During the Kobe earthquake in Japan decisions had to be made as to whether to combat active fires or rescue trapped people. The outcome was inevitable and tragic (Borden, 1995).

The National Fire Academy Course, Executive Analysis of Fire Department Operations in Emergency Management highlighted the need for capability assessment in preparing for disasters. This study relates to that topic by evaluating the possible drains on human resources that would normally be available to the local fire department.

It is necessary for each community to assess the hazards it may face and weigh its vulnerability to each one. They should then complete an inventory of the resources

that would be available to respond to those situations (Spillman, 1996). It is important to examine the numbers to make sure that one person is not filling multiple roles.

“Even the largest fire departments in the country cannot handle every incident to which they respond by themselves.” (Endrikat 1998)

LITERATURE REVIEW

The nature of natural disaster

“Disaster management differs from emergency response in that a disaster is a dangerous event that causes significant human and economic loss and requires a response beyond the scope of any single agency or service.” (Spillman, 1996) Natural disasters are generally considered to be the results of a wide range of climate or weather related events that cause extensive damage to the possessions and routines of the local population. They are often realized as the extremes of normal weather conditions. Droughts, floods, hurricanes, tornadoes, landslides, sleet and hail, damaging winds, blizzards and earthquakes are examples of these disasters. The resulting mitigation and recovery periods can last from days to weeks (Spillman, 1996).

Natural disasters normally tax the local fire department because of their inherent cascading effects. These effects are the resulting situations that follow the precipitating event. Examples of this would vary from a person trapped in a river because of the failure of a storm-weakened bridge to the loss of revenue caused by power outages in a retail district. Because many of these effects either threaten or cause the loss of life and property, they are traditionally responded to by the local fire department.

Earthquake

On average, more than 2,000 earthquakes exceeding 5.0 on the Richter scale are recorded worldwide. At least one will measure between 8.0 and 8.9 (Borden, 1996). The United States Geological Services rate earthquakes that exceed 4.9 as “Moderate”. Those exceeding 5.9 are “Strong”. Those exceeding 6.9 are considered to be “Major”. And any earthquake measured at 8.0 or above is listed as “Great”. Borden cites statistics that 15 “Major” earthquakes will occur in an average year.

On January 17, 1994 an earthquake measuring 6.7 struck the San Fernando Valley in northern Los Angeles. In the following days, numerous aftershocks of lesser magnitude continued to shake already weakened structures and facilities. This has been referred to as the “Northridge Quake”.

The damage that resulted from this event included the rendering of approximately 2,800 buildings as being “unenterable”, and many older structures suffering complete collapse. Public utilities were interrupted because of the downing of many electrical lines and at least 1,400 breaks in natural gas delivery pipes. The highway and road system was compromised by the collapse of many bridges and overpasses. Telephone communication systems were either interrupted or jammed by overuse during the early stages of the emergency. Water mains also suffered extensive damage. This made it necessary to transport potable water to the affected citizens and severely limited the firefighting capabilities in the area (Foley, 1995).

One year later a major earthquake struck the city of Kobe, Japan. Although the city was not on a major fault line the liquefaction of the ground beneath it made it highly vulnerable to movement.

The first response by the emergency services in the Kobe area was completely overwhelmed by the magnitude of the destruction. In the hours and days that followed, mutual aid responded from as far away as Tokyo, which is 300 miles from the city. The arrival of incoming resources was delayed because of debris-blocked roads and structural damage to the highway system (Borden, 1995).

The resulting statistics for the quake reported 5,000 people dead and over 106,000 buildings destroyed. It was also reported that many of the casualties were

people that were trapped alive in collapsed structures and burned to death in the firestorms that followed (Collins, 1995).

Tornado

In the first six months of 1998 more than 45 tornadoes have been responsible for the deaths of almost 150 people in the United States. They have occurred from the Midwest area of the country into to the eastern states of Florida and Georgia. They have also struck as far north as New York and Pennsylvania. Many of the tornadoes that have recently occurred are the trailing results of the El Nino effect that interrupted weather patterns on the west coast during last year (Spivak-A, 1998)

In Michigan one storm generated five tornadoes that touched down in five separate counties. Firefighters in these areas were called upon to control the resulting hazardous conditions by shutting off gas meters, pinching off broken gas lines, pulling electrical meters, and shutting off operable circuit breakers in damaged structures. They were also engaged in search and rescue operations at collapsed structures. This was in addition to their responses to extinguish numerous fires that had been caused by the storm (Zawlocki, 1998).

The destruction caused by a tornado can overwhelm most local first responders because of their size and the distance that they cover. One fire chief reported that they

had 70 homes destroyed in a period of fifteen minutes (Garlock, 1998). A tornado in Will County, Illinois left a path of destruction that was 700 feet wide and almost seven miles long.

During one tornado a local fire department's response was severely hindered because two of its three fire stations were destroyed by the storm (Campbell-A, 1998). Another problem affecting fire department response was noted in Florida when a tornado had knocked down or destroyed a number of street signs in a disaster area. This slowed the response of fire companies and emergency medical services because they could not tell the names of the streets and were forced to count blocks to find the addresses they had been dispatched to (Spivak-A, 1998).

Hurricane/Tropical Storm

Hurricanes are the deadliest of natural disasters that have struck the United States. In 1900 a hurricane struck Galveston, Texas resulting in the deaths of 6,000 people. Although the barrier islands and coastal areas are the most prone to severe damage, a hurricane can sustain its 74 to 160 mile per hour winds inland for hundreds of miles. Hurricanes can also spawn tornadoes, cause flooding, or trigger landslides from their torrential rains.

Hurricane Andrew in 1992 is listed as one of the most expensive natural disasters in the history of the United States. Of the 54 deaths that were attributed to the

storm, 18 occurred during the recovery phase. Of these, three people were killed due to unstable areas and two children died in fires in damaged homes (FEMA Hurricane, 1998).

Following a hurricane in Acapulco there were multiple problems encountered by mutual aid resources. In one instance ambulances were not able to enter the city because of extreme darkness due to the loss of electrical power. Another ambulance was disabled after becoming stuck in a large pothole in a storm-damaged street (Spivak-B, 1998).

Tropical storms have sustained winds of up to 73 miles per hour. This differs from hurricanes by one fewer miles per hour. In 1994 two tropical storms were responsible for 37 deaths in the United States. These storms accounted for nearly \$900 million dollars of property damage (FEMA Strength, 1998).

Flood

“Moving water and floods kill more Americans annually than any other natural catastrophe.” (Segerstrom, 1996) An average of 200 people die in the United States each year because of flooding or other moving water incidents.

During 1996 summer floods in Pennsylvania, Maryland, and Virginia were caused by five consecutive days of rain associated with a hurricane that had been

downgraded to a tropical storm (Segerstrom, 1996). Flooding conditions not only make access to burning buildings difficult they also can increase the types and numbers of tasks for firefighters. Many times firefighters are the primary source of personnel used to evacuate flood-endangered citizens in their community. They may also be called upon to set up temporary shelters within their fire stations (Carlson, 1997). During the Midwest floods of 1997 temporary emergency rooms were set up in local fire stations because local hospitals had been flooded (Spivak, 1997).

Drought/Wildfire

In 1996 Long Island was suffering from the worst drought it had faced in 87 years. During this time it faced several wildfires that were much larger than had been experienced in that area. One of the main problems was encountered because of the use of firefighters that were trained primarily as structural firefighters in a wildland type situation (Hashagen, 1996).

With the reduction in federal, state and local firefighting personnel it will become more prevalent for structural firefighters to respond to wildland interface fires (Francis and Lowden, 1998).

“We never thought we’d see the day when we would ask for one pumper from each department in Nassau County. Not to mention the ten from New York City.”

(David Fischler, Chief Fire Marshall, Suffolk County, NY)

Winter storms

In 1997 the Federal Emergency Management Agency responded to 43 major disasters in the United States. Approximately one third of these disasters were attributable to winter storms (Campbell-B, 1998).

A major winter storm coated portions of New York State and New England with several inches of ice during January of 1998. As a result of this local firefighters were overburdened with an increased workload and numerous requests for public assistance. Among the problems that they faced were; downed powerlines, blocked roads, flooded homes and businesses, and many areas with no electricity or water. Fire departments were called upon to assist with medical calls because of transportation problems. They were also used to help elderly and incapacitated citizens that were without food, water, or needed medications (Downey, 1998).

Because of the overwhelming amount of people with that were seriously affected by this disaster the statewide mutual aid plan was placed in effect from January 8th to January 25th. The Augusta, NY Fire Department doubled up on its staff and

many members worked 90 or more hours without time off. During a four day period they responded to 266 emergency calls. Rescue Company 4 of the New Rochelle Fire Department responded to Platsburg, NY where they spent four days assisting the local department. They reported getting an average of two and one half-hours sleep each night.

In Watertown, NY the public works department worked closely with the fire department. Whenever the fire department responded to an alarm the public works led the way with snowplows. Also rescue crews with chain saws were used to cut through downed trees and poles that were blocking roadways.

Firefighters were employed to transport people from homes with no heat to shelters or the fire stations themselves for safety. The river reached flood stage and many members were busy pumping out cellars to prevent further damage. Fire responses also increased significantly because of the misuse of non-electric heaters. These include fireplaces, wood stoves, kerosene heaters, and even candles (Davolt, 1998). These devices contributed to the increase of carbon monoxide calls during the storm (Antes, 1998). Approximately one-half of all storm related fatalities were attributed to carbon monoxide poisoning (Downey, 1998).

Chief of State's Fire Services, John Mueller observed, "Virtually every fire department in the state provided some form of assistance to the affected counties."

The demands on personnel

Ray Downey (1998) observed that during a disaster department members may be called on to do anything from firefighting to rendering family assistance. The varied demands on the firefighting personnel can rapidly deplete the human resources that have initially responded to a natural disaster.

Emergency operations dealing with collapsed excavations or structures are extremely demanding on human resources. Even a simple extrication of one victim from a trench cave-in can involve as many as 8 to 10 rescuers (IFSTA, 1996). Thirty-five rescue personnel from one fire department required 45 minutes to shore a 4-foot by 12-foot trench to remove one victim. If a structural collapse has occurred the demands may be even greater. When using power tools such as concrete breakers or saws it becomes necessary to rotate operators on a regular basis (Gustin, 1995). Accardi (1997) explains that when digging with power tools, it often becomes necessary to use “bucket brigades” to remove spoil from the excavation site. Using personnel in this manner may be necessary but causes a steady draw on resources.

Other demands on human resources are simpler but often essential. When police officers are not available it falls upon the fire department to direct traffic during emergency operations. Zawlocki (1998) highlights that traffic control can be essential to open streets for rescue and emergency medical personnel to have access to the people

that need them. During one storm a local hospital requested the fire department to assign some of their firefighter/EMT's to assist with patient care in the emergency room (Granito, 1995).

Disaster operations can also be very time consuming. Granito (1995) observed that disaster operations could actually begin prior to the actual event. This would include assembling at the fire station to standby or assisting with evacuations from endangered areas. When operations are extended past a normal workday the use of relief crews becomes essential. When FEMA teams are deployed they operate on a 12-hour on, 12-hour off schedule. Each basic squad consists of one officer and five specialists. This number must be doubled for a continuous operation.

“Members who are not provided adequate rest and rehydration during emergency operations or training exercises are at increased risk for illness or injury” (United States Fire Administration, Emergency, 1992). Arrangements must be made for the feeding, sleeping, and sanitary needs of rescuers during extended operations (IFSTA, 1996). It may even become necessary to provide medical rehabilitation for personnel (O'Brien, R., 1997). Furey (1998) reminds us that it is important to manage resources to provide the appropriate breaks and maintain required staffing levels for not only responders but dispatch personnel as well. During the wildfires on Long Island the Red Cross provided food and resting areas for firefighters. While in these rehabilitation

areas personnel were given medical evaluations and even provided with stress-relieving therapy by massage teams (Hashagen, 1996).

Staffing for suppression

The former Chief Engineer of the Los Angeles Fire Department, Raymond Hill addressed the effects of fire company staffing in the terms of “principals of mass action” (Reardon, 1998). Hill states, “A superior force (mass action) must be concentrated at the critical time and place in order to obtain results. The force used must be greater than that which is ‘just adequate.’”

The initial attack capability as recommended by the National Fire Academy represents the number of personnel that must be on scene within the first ten minutes of the dispatch for a structure fire. For a minimal operation of a single 200-foot hoseline, search and rescue, ventilation, support and command in a typical residential structure requires at least ten firefighters (Carter, 1997).

A study of company staffing was conducted in Auburn, Alabama to determine the effects that varied numbers of personnel would have on common fireground tasks. The general conclusion was that the more hands available the quicker the task was accomplished. However, the measurable differences varied with the complexity of the tasks. The greatest difference was seen during their fourth scenario when three

firefighters accomplished a task in 24% less time than two firefighters. The scenarios were arranged so that safety and effectiveness remained constant and the measurable difference was time (Lawrence, 1995).

After conducting a study of firefighter injuries in 1995, Karter and LeBlanc, (1996) concluded that the numbers of injuries increase proportionately to the number of fires suppressed. They recommended that departments ensure that enough personnel respond to cover both firefighting and overhaul to maintain safe operations and prevent injuries.

Overcoming capability shortfalls

If a fire department can't supply the resources it may need it should identify where it will get them. After it identifies the sources of assistance it is necessary to maintain and update a list of contacts for their deployment. All agreements should be reviewed and reaffirmed periodically (IFSTA, 1996).

These agreements can lead to forming task-oriented teams such as California's Bay Area Search and Rescue Council or Illinois's Combined Area Rescue Team. The C.A.R.T. is comprised of seven teams from 46 separate fire departments. Their response is tiered to meet the level of operation needed for a given incident. By coordinating a number of teams from a widespread area they can overcome situations that normally would drain a single resource (Schofield, 1998). The Bay Area Search

and Rescue Council reports having 1,000 volunteers from 21 search and rescue organizations. Young and Cooke (1996) state that the primary lesson of the council is the fact that it was possible to bring together a large number of diverse teams to create a larger and equally effective mutual aid effort.

The importance of support operations

Communities function around a lifeline system that consists of its utilities, transportation systems, and communications. During a natural disaster these services are often interrupted (Borden, 1995). Public utilities play an essential role in the health of the citizens and electric power generally supports them (Brewster, 1996). The need for rapid power restoration is becoming even more important because of the shifting of patients from hospitals to home health care facilities. There is an increasing number of people that need electrical power to operate life-supporting medical equipment in their own homes (Wolf-A, 1998). Because of this and the dangerous reliance on fire for heat and light during a winter storm make power loss a primary issue in stabilizing a disaster. Loss of electric power was also seen as a factor in the failure of traffic signals following the storm. This then caused traffic problems that further slowed the response of fire companies and mutual aid resources (Downey, 1998).

Response of the electrical utility employees can be even more critical when energized powerlines are entangled in downed trees and damaged structures. It is critical for these situations to be stabilized to prevent would-be rescuers from becoming victims themselves (International Fire Service Training Assoc., 1996).

The local public works department also becomes an essential service because of the need to open and maintain roadways and stabilize overhead hazardous situations. Following one storm in Georgia a weakened tree limb fell on a fire apparatus that was responding to an emergency. The cab was crushed, firefighters were injured, and the apparatus was unable to continue to its call. It then took nearly two hours to reopen the road (Garlock, 1998).

Garlock (1998) cited the need for the public works street sweepers to be put into operation immediately following any storm that causes serious damage to structures. This is to clear the streets of nails and other objects that can puncture tires. One Georgia department reported suffering 12 flat tires while responding to emergencies after tornadoes struck their district. In Will County, Illinois, fire departments had to employ three separate tire dealers to supply the needed spares following a major tornado strike (Garlock, 1998).

The local threat

The city of Kobe was not located on a major fault line, but suffered major damage when a belt of strike/slip faults ruptured (Collins, 1995). Morris County, although not located on a major fault line has experienced two earthquakes (magnitudes 1.2 and 1.9) during the month of June, 1998 (Lamont Cooperative Seismic Network, 1998). Typically older structures and structures such as parking decks are susceptible to damage and collapse during seismic events (IFSTA, 1996).

Because of the severe thunderstorms that are being experienced in New Jersey more tornadoes and incidents of flooding are occurring throughout the state (Master Planning Advisory Council, 1997). Tornadoes have been spotted or touched down in the counties that border Morris County to the north and south. (O'Brien, K., 1998). The governing body of Morristown, NJ has expressed concern over the development of flood prone areas of the town following recent incidents (Swayze, 1998). And Swayze also reports that heavy storms are being predicted for this winter season.

Summary

Natural disasters strike in diverse communities with extremely devastating effects on both the immediate as well as the long-term welfare of its people. Because of

the cascading problems caused by a disaster, agencies that usually function in supporting roles can become essential elements of hazard mitigation.

The demands made on local fire departments during these events can be overwhelming and totally exhaust their immediate resources. However, they are still responsible for the protection of their community and require human resources to maintain fire suppression activities.

New Jersey is one of the most densely populated states in the country and is as vulnerable to natural disasters as any other (Master Planning Advisory Council, 1997).

One of the biggest problems we face in Morris County is apathy because no major disasters have ever happened here (R. Loock, Morris County OEM , personal communication, 1998).

“The overall ability of the authority having jurisdiction to function safely and effectively is greatly dependant upon the prompt availability of appropriate tools, equipment, and supplies to accomplish operations (National Fire Protection Agency 1470, 1994).

PROCEDURES

Research Methodology

Historical research was used to conduct a literature review of pertinent information on the subject of fire department response to natural disasters. This search began with the use of the National Fire Academy's Learning Resource Center's On-line card catalog. Recent issues of fire service trade magazines were scanned for relevant articles. Local newspaper stories relating to the research topic were noted and filed for use. An electronic search of the Internet was also conducted using the search engines; Yahoo, Hot Bot, and Web Crawler. Using this information, links were established with United States Geological Services, Columbia Education, and FEMA's Stormwatch and Library. This source supplied the maps for research and illustration.

A personal interview was conducted in June of 1998 with Mr. William Egbert, the Morris County Mutual Aid Coordinator, to obtain information regarding the mutual aid plans detailing agreements of local departments. He provided a list of contacts for thirty-six of the county's fire chiefs.

A personal interview was conducted on August 20, 1998 with Mr. Rick Look, the Director of the Office of Emergency Management for the County of Morris. This was to gather information on the current status of mutual aid agreements between

Morris County and its surrounding jurisdictions. It also served to research the past history of natural disasters that have affected this area.

A questionnaire was distributed to the active fire chiefs in Morris County. (Appendix B) The cover letter explained the purpose was to survey the number of active firefighters in the county and list those members that could be committed to other agencies during natural disasters. (Appendix A) Thirty-six of the county's thirty-eight departments were mailed packets containing the cover letter, questionnaire, a stamped return envelope, and a separate postcard to request copies of the results. The postcard was to allow chiefs to respond confidentially. Thus, protecting their anonymity regarding any comments they wanted to make.

Sixteen surveys were received for a return rate of 44%. That figure was then used to establish representative numbers for each community of the county. Those numbers were then used to chart the personnel that could be subtracted from the available firefighting forces during disaster operations. The chart is presented in the Results section of this paper and observation are made in the Discussion.

Assumptions and Limitations

The literature review was mainly focused on fire service operations during natural disasters while attempting to discover the tasks required of public works and

utility employees. The search did not include public works or emergency management journals or periodicals. Those sources could have possibly given better perspectives on that subject.

The questionnaire was distributed to fire chiefs in Morris County only. Although this number does not represent the fire service as a whole it should have given an accurate indication of the personnel resources in the local area.

It was also understood that the numbers supplied by the fire chiefs could vary greatly from year to year because of the continual turnover in personnel and individual career changes.

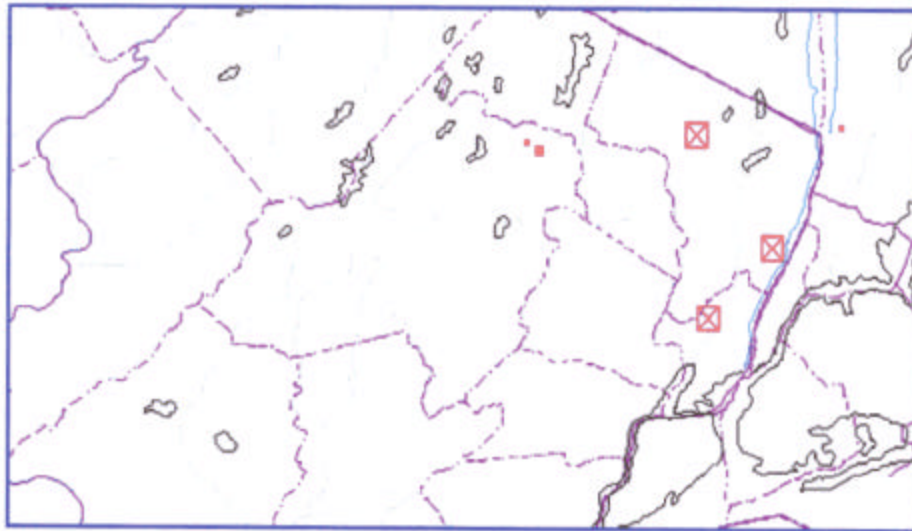
The numbers presented in the chart represent averages calculated by the number of questionnaires returned.

Wildfire mitigation was not covered because of the limited interface in the Morris County area.

RESULTS

Answers to Research Questions

Research Question 1. Although Morris County is not located directly over a major fault line the possibility of suffering earthquake damage cannot be ignored. Two earthquakes were recorded in Morris County during the month of June 1998. The first occurred on the 20th 1.6 km SE of Kinnelon. The second was recorded on the 30th 2.9 km S of Butler. They measured 1.2Mc and 1.9Mc respectively.



The locations of these quakes are represented as red marks in the NE section of Morris County. Morris County is the area in the center of the map. (columbia.edu, 1998)

The Morris County Office of Emergency Management had not kept detailed records prior to the current Coordinator's arrival. Therefore, details of tornado strikes are limited to personal communications from past directors of the local OEM office. In 1973, two funnel clouds were spotted in Morristown and Morris Township. They caused numerous street closings and were reported to have destroyed at least one residence in the Washington Valley area of the Township.

It has been noted that because of increasing thunderstorm activity in the area the possibility of tornado strikes is becoming more prevalent. There have been funnel clouds reported in two adjacent counties during the summer months of 1998.

Hurricanes and tropical storms usually have their greatest destructive effects on barrier islands and in coastal areas. However, it was also noted that the high winds could extend over 100 miles inland. Morris County is located within 50 miles of the New Jersey coast.

During 1982 Lincoln Park, NJ experienced flooding conditions that required a countywide mobilization to assist with victim rescue and cellar pumping. During 1996 the Town of Morristown was divided by a flashflood that trapped several people in swift waters and required mutual aid for rescues and evacuations.

The winters of 1994 and 1996 struck Morris County with numerous storms

including a blizzard that was declared a statewide emergency. The current prediction is for a harsh winter with heavy snows in 1998.

Although Morris County has not suffered any catastrophic devastation from natural disasters it is susceptible to any of those highlighted in this report.

Research Question 2. After the occurrence of a natural disaster one of the main priorities is the opening of roadways to allow for movement of critical care and emergency services. This assignment is traditionally given to the local department of public works. The associated tasks may include removal of downed trees and debris or plowing snow. In some incidents emergency road repairs may be needed as in the case of the ambulance that was stuck in a large pothole. It was also noted that street sweepers need to be deployed after any destructive event to remove nails and other debris from roadways to prevent tire damage. During one incident several fire apparatus were unable to respond to emergencies because of flat tires.

The restoration of electrical power is a critical need because of the increasing number of people that are on life support systems in their own homes. The operation of other utilities such as water and sanitation generally depends on having electrical power. Thus, it becomes essential to have service restored to prevent further health and safety hazards to the public.

In a flood event the public works department is often used to supply diking materials. This involves the use of heavy equipment such as bucket loaders, backhoes, and dump trucks.

Public works personnel and vehicles may also be used to transport victims during evacuations or bring shoring materials to collapse sites.

Research Question 3. The National Fire Academy recommends that at least ten firefighters be on the scene prior to initiating an interior attack of a structure fire. This includes two firefighters to operate a hoseline, two assigned to search and rescue, two for ventilation, one pump operator, and one each assigned to safety, support, and command.

The State of New Jersey has been seeing a steady decline in volunteer membership over the last decade (Hester, 1998). Thus when conducting a Community Risk Analysis it is important that the inventory of emergency resources be as accurate as possible (Spillman). When disasters strike there may be a reduction in available resources because personnel could be committed to other agencies.

Chart rational

During the Executive Analysis of Fire Service Operations in Emergency Management class it became very clear that a fire department needs to depend on support from numerous agencies to successfully function after a natural disaster event. Because the make-up of the Morris Township and other local fire departments consist mainly of volunteers it is necessary to determine the number of their members that could be committed to other agencies during these events.

The following chart was made to serve as a guide for fire officers to use when assessing their resources. Each department can vary it as needed.

An average number of volunteers were calculated by projecting the numbers listed on the returned questionnaires and dividing them by the number of departments surveyed. The average fire department was estimated to have 37 active firefighters. The other numbers were then calculated, averaged, and entered into the following chart. These results will be reviewed in the Discussion.

TASKS	EVENTS				
	Earthquake	Tornado	Hurricane/ Tropical Storm	Flood	Winter Storm
Power Restoration	1	1	1	0	1
Street Access	3	3	3	3	3
Other Utilities	1	1	1	0	1
Security/ Traffic Control	2	2	2	2	2
Medical Aid	1	1	1	1	1
Medical Transportation	2	2	2	2	2
Call Backs	1	1	1	1	1
Mutual Aid	4	4	4	4	4
Totals:	15	15	15	13	15

Chart A. Factors reducing available volunteers. (Appendix D)

The actual survey numbers (totals) were:

1. Please estimate the number of “active” firefighters in your department. 589
2. Referring to the number in question 1, are any of your firefighters;
(if yes, please list numbers)
 - A. Road and Sanitation Employees 52
 - B. Public Utility Employees (i.e. GPU, PSE&G) 4
 - C. Police Officers 24
 - D. Career Firefighters in a town other than yours 9
 - E. Hospital Employees (nurses, paramedics, ER tech.) 15
3. Does your department allow members to be active in other emergency response organizations? (I.e. other fire depts., first aid squads, OEM, etc.)
15 Yes 1 No
4. If yes to 3., how many personnel could be involved with those agencies? 67
5. Does your department operate an EMS/Transport service?
3 Yes 13 No
6. If yes to 6., how many personnel are would be needed to operate that service?
26

DISCUSSION

The Master Planning Committee of the State of New Jersey has determined that the state is susceptible to earthquakes, hurricanes, and floods. These events can cause building collapses with entrapment, the need for extrications of injured people, and the initiating of a “disaster response”.

However, because Morris County has not experienced these types of events on a large or frequent scale, many local fire departments have become complacent regarding these threats.

When assessing personnel resources many local departments are concerned only with structure fires or other localized emergencies. When a shortage is noted, it is usually covered with a mutual aid agreement. It should be noted that there are several mutual aid pacts in Morris County that have historically functioned well.

When a natural disaster strikes local departments could be overwhelmed (Gannon, 1998). During the Kobe earthquake decisions had to be made whether to rescue trapped people or combat the raging fires. Many of the victims burned to death where they were trapped.

One of the major problems during a natural disaster is the interruption of the community's infrastructure. That is the system of roads, bridges, utilities, electric service, potable water, wastewater, natural gas, telephone communications, and others. These elements need to be maintained for the health and safety of the people in the affected areas (Brewster, 1996). This is the reason that a number of volunteer firefighters who are employed by these services may not be available when needed for fire suppression. Under normal circumstances they could leave their jobs. But, during these types of events the completion of their job tasks are critical.

When fires occur during natural disasters they can often grow quickly because of the arrangement of fuel in damaged structures. Lawrence (1996) reminds us that the more complex the task the more hands that are needed. He observed that when stairs are weakened or damaged by an earthquake it takes several more firefighters to raise a ladder to access upper floors.

Because of the necessity to fill support roles many volunteers may not be available for fire suppression duties. Using the chart from Appendix D may help to focus understanding of personnel assignments and deficiencies during disaster.

One area that was overlooked on the questionnaire, but mentioned by a respondent, was the availability of volunteers that commute to their workplaces. If an

event were to occur when those people are away from their areas, they may not be able to return to their locales. This would be the case as when a blizzard strikes during working hours and commuter lines are shut down. This should also be considered.

It is important to prearrange mutual aid from greater than normal distances for natural disasters. Most of these events affect several adjacent towns. Because of this mutual aid will not be available from neighboring communities (FEMA, 1992). Response will have a longer travel time (Wolf, 1998). Streets cluttered or blocked by debris and traffic jams due to failed traffic signals will also delay the arrival of assistance (Collins, 1995). The longer the wait for help, the more the fire will grow and the harder it will be to control (Reardon, 1998).

Mutual aid will be necessary in most disasters simply because of their size and added tasks and duration. Approximately 80% of all responses during natural disasters are emergency medical calls (Williams, 1997). When first aid squads are overwhelmed they often request assistance from the fire department. This also reduces human resources.

Studies show that properly rehabbed firefighters suffer fewer accidents and injuries (National Institute of Safety and Health, 1991). If the time needed to mitigate an event is going to extend past normal working hours, relief crews are necessary. This

can more than double the number of personnel needed on the scene. In addition to a second rescue crew it will be necessary to provide for the rehab of the off-going shift.

During the ice storms of 1998, the New York State mutual aid system responded with 341 firefighters from 46 counties and equipment from 553 departments (Antes, 1998).

RECOMMENDATIONS

The literature review presented the fact that although this geographical area has not been severely or regularly affected by natural disasters, there is a strong possibility that they could occur within the near future. The review explained the need for personnel to carry out support operations during natural disasters and the influence they could have on fire department staffing. It also addressed the need for minimum numbers of firefighters to be available for structure fires.

Regardless of all the preparations we make through pre-incident planning, training, and so on, the major contributory factor in achieving a quick knockdown and stabilization is having an adequate force on the scene to initiate and support an effective attack (Reardon, 98).

It was the author's original intention to examine the relationship between volunteer firefighters' occupations and the need for their services during natural disasters. However, while researching the material it became apparent that many of the local departments have become complacent regarding these events and the shortfalls they could incur.

"The Kobe or 'Great Hanshin' earthquake should have sent a mental shockwave to us, especially in regions with low-to-moderate risk..."(Borden 1995).

Because of this the author created the worksheet in Appendix C. It is hoped that other departments will use this worksheet and this report will alert area chiefs to the possible situations they may encounter. It is important to adopt an "it can happen here" attitude (Downey, 1995).

The recommendations of this report are to realize that these disasters are occurring throughout the country and prepare for dealing with their effects. The most likely event appears to be that of a severe winter storm. Because of changes in weather patterns and local history it is highly probable that this could occur.

The State of New York has a well-developed and proven plan for mutual aid. This plan could be examined and adapted to the State of New Jersey.

Local fire departments should meet with their county OEM directors and establish large scale plans to meet their needs until a State plan is established. When the earthquake struck Kobe, assistance came from throughout the entire country of Japan (Collins, 1995).

“Whether we are responders, planners, designers, builders, volunteers, or private citizens, we all have a responsibility to others and the community in which we live” (Borden, 1995).

“Hope for the best...but plan for the worst” (Grannito, 1995).

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Earthquake Info From ldgo.columbia.edu

FEMA, Hurricanes, Tropical Storms, Library

USGS Hazard maps Fact Sheet

APPENDIX A

FIRE DEPARTMENT
35 WOODLAND AVENUE
P.O. BOX 7603
CONVENT STATION, NEW JERSEY 07961-7603
FAX 973-326-1728

THOMAS W. GAYLORD
CAPTAIN

(973) 326-7460

07/30/98

Dear Chief,

I am currently researching information for an Applied Research Project as part of my requirement for the National Fire Academy's Executive Fire Officer Program. My most recent class was "Executive Analysis of Fire Service Operations in Emergency Management".

Part of the course curriculum addressed the subject of "capability assessment". This subject made it clear that the needs generated by a natural disaster extend far beyond the geographic and logistical reaches of our departments. As an example, during a hurricane there may be flooding conditions that require public works employees to clear roads and haul diking materials. At the same time there may be utility lines down causing those employees to respond to their jobs. If then, there is a fire or building collapse, we may not have as many personnel available as we have anticipated. And as hurricanes rarely strike one town at a time, our mutual aid departments could also be facing similar events.

The purpose of my research project is to evaluate the probabilities of several of the typical natural disasters that could strike Morris County and compare the associated tasks to the number of projected available personnel.

Please take a few minutes to fill out the questionnaire included with this letter. In listing your "active" firefighters, please estimate the number of members that normally perform actual firefighting and rescue operations in the field. (Please also note that you are not asked to give any identification of your department on the survey. Individual statistics will be kept confidential. The results of the survey will be presented in hypothetical situations and broad observations.) Then estimate the numbers of personnel,

if any are involved in the listed occupations or activities. Because these numbers vary with personnel turnover, rough estimates are fine. Again this is just to present trends or possibilities.

If you would like a copy of the survey results or the final report itself, I have included postcards that can be mailed to me separately. (This will also help maintain the anonymity of the survey.)

Thank you for your anticipated cooperation. If you have any questions or comments please feel free to call, write, or e-mail me at the following:

Tom Gaylord	(973) 285-0322 (home)	email: tgaylord@worldnet.att.net
23 Junard Dr.	(973) 326-7460 (work)	
Morristown, NJ 07960		

Sincerely,

APPENDIX B

1. Please estimate the number of “active” firefighters in your department. _____

2. Referring to the number in question 1, are any of your firefighters;
(if yes, please list numbers)
 - A. Road and Sanitation Employees _____
 - B. Public Utility Employees (i.e. GPU, PSE&G) _____
 - C. Police Officers _____
 - D. Career Firefighters in a town other than yours _____
 - F. Hospital Employees (nurses, paramedics, ER tech.) _____

3. Does your department allow members to be active in other emergency response organizations? (i.e. other fire dept.s, first aid squads, OEM, etc.)

4. If yes to 3., how many personnel could be involved with those agencies? _____

5. Does your department operate an EMS/Transport service?
 _____Yes _____No

6. If yes to 5., how many personnel are would be needed to operate that service? _____

7. Please list any other commitments that might prevent your members from responding to a natural disaster.

8. Please add any comments that you would care to make.

APPENDIX C

TASKS	EVENTS				
	Earthquake	Tornado	Hurricane/ Tropical Storm	Flood	Winter Storm
Power Restoration					
Street Access					
Other Utilities					
Security/ Traffic Control					
Medical Aid					
Medical Transportation					
Call Backs					
Mutual Aid					
Totals:					

Chart A. Factors reducing available volunteers. (Appendix D)